

$$T = \begin{pmatrix} T_{11} & T_{12} \\ T_{21} & T_{22} \end{pmatrix}, \quad T_{11} = \frac{1}{\sqrt{\lambda_1}} \begin{pmatrix} \cos^2 \theta & \sin^2 \theta \\ \sin^2 \theta & \cos^2 \theta \end{pmatrix}, \quad T_{12} = \frac{1}{\sqrt{\lambda_1}} \begin{pmatrix} -\sin \theta \cos \theta & \sin \theta \cos \theta \\ \sin \theta \cos \theta & -\sin \theta \cos \theta \end{pmatrix}$$

- [c1] 1. A rings-based system on a chip, comprising:
a plurality of ring members on a ring network that communicate using point-to-point connectivity;
a message traversing the ring from member to member;
the system being adapted so that upon the message arriving at a given ring member the message is processed by that ring member if the message is applicable to that ring member, and if the message is not applicable to that ring member, the message is passed on to the next ring member; and
the system being adapted so that downstream adjacent ring members provide a signal to their upstream adjacent ring members that indicates whether a slot is available for the upstream ring member to pass the message to the downstream ring member on a given clock cycle.
- [c2] 2. The system of claim 1, wherein receipt of the signal indicating that a slot is not available causes the upstream ring member not to pass the message on that clock cycle.
- [c3] 3. The system of claim 1, wherein each ring member provides the signal to the immediately prior ring member each clock cycle.
- [c4] 4. The system of claim 1, wherein each ring member couples to the ring network by a ring interface, and wherein the signals regarding slot availability are passed between adjacent ring interfaces.
- [c5] 5. The system of claim 4, wherein the ring interface includes an input FIFO and a through FIFO.
- [c6] 6. The system of claim 5, wherein the signal is generated by the downstream ring member and passed to an immediately upstream ring member holding the message, and wherein the signal is generated according to the FIFO for the downstream ring member that pertains to the message.
- [c7] 7. The system of claim 6, wherein downstream ring member determines that the input FIFO pertains to the message if the message is to be consumed by the downstream ring member and that the through FIFO pertains to the message if

the message is not to be consumed by the downstream ring member.

- [c8] 8.The system of claim 7, wherein the signal indicates that a slot is available when the input FIFO pertains to the message and the input FIFO can accept a message.
- [c9] 9.The system of claim 7, wherein the signal indicates that a slot is available when the through FIFO pertains to the message and the through FIFO can accept a message.
- [c10] 10.The system of claim 7, wherein the determination is made by the downstream ring member examining information descriptive of the message before the message in its entirety is sent from the upstream ring member to the downstream ring member.
- [c11] 11.The system of claim 10, wherein the information comprises data from a type field and an address field for the message.
- [c12] 12.The system of claim 1, wherein the signal is a backpressure signal that is generated based on data sent from the upstream ring member to the downstream ring member and then back to the upstream ring member in a round trip fashion during a single clock cycle.
- [c13] 13.The system of claim 1, wherein each ring member has a ring interface, and further wherein each ring interface has four interfaces using or providing the signal which comprises a backpressure signal.
- [c14] 14.A method of controlling the transmission of messages on a ring network comprising a plurality of ring members, comprising:
providing a message at a first upstream ring member that is available for output to a second adjacent downstream ring member;
receiving a signal at the upstream ring member from the downstream ring member that indicates whether a slot is available for outputting the message on a clock cycle; and
outputting the message from the upstream ring member to the downstream ring member if a slot is available and holding the message if a slot is not

available.

- [c15] 15.The method of claim 14, wherein the signal is generated based on the content of the message.
- [c16] 16.The method of claim 15, wherein the signal is generated based on whether the message will be consumed by the downstream ring member or pass through to a further downstream ring member.
- [c17] 17.The method of claim 14, wherein the downstream ring member is coupled to an input FIFO and a through FIFO, and wherein the downstream ring member determines which FIFO pertains to the message.
- [c18] 18.The method of claim 17, wherein the downstream ring member determines whether the pertinent FIFO is capable of accepting the message.
- [c19] 19. The method of claim 15, wherein the content includes at least a portion of the message type.
- [c20] 20.The method of claim 15, wherein the content includes at least a portion of the message address.